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(71) Applicants

Andrew Gunn
Kirkden House, Letham, Angus DD8 2QF Scotland

Ian David Cameron, 10 Macnabb Street, Dundee
DD4 7EH Scotland

(72) Inventors

Andrew Gunn
Ian David Cameron

(74) Agent and/or Address for Service

Cruikshank and Fairweather
19 Royal Exchange Square, Glasgow G1 3AE,
Scotland

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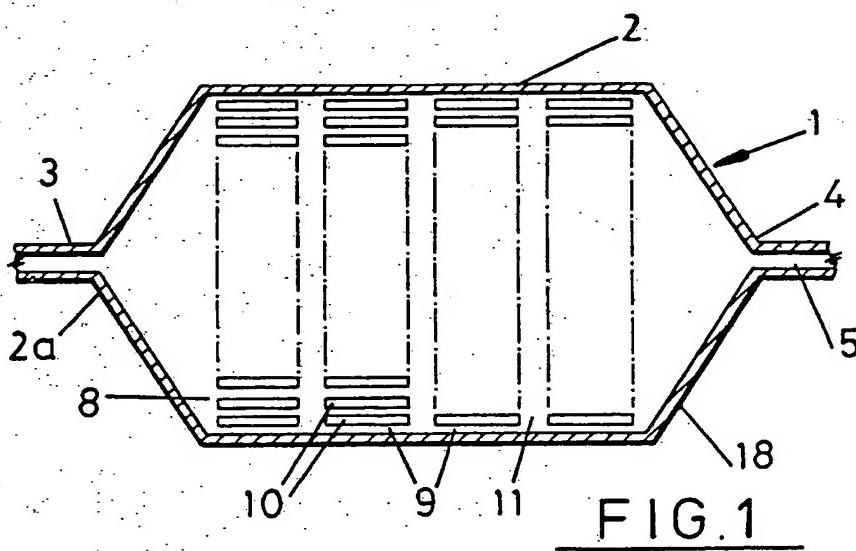
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GB 0639467 GB 0574803 GB A 0321639
EP A1 0240152 EP A1 0138489 US 3894236

(58) Field of search
H5R
A5R
Selected US specifications from IPC sub-classes
A61M A61N H01J

(54) Body fluid processing device

(57) A device 1 suitable for use in the ultra-violet irradiation of a fluid such as blood or a fraction thereof comprises a vessel 2 having an inlet 3 and an outlet 5 and a passage means 8 extending therebetween. The said passage means 8 has wall means substantially transparent to ultra-violet irradiation, and at least one irradiation zone 10 extending along and in substantially direct proximity to the wall means, and at least one mixing zone 11, formed and arranged for thoroughly mixing fluid passing therethrough so as to bring substantially the whole of it into a said irradiation zone 10 during passage between the inlet 3 and outlet 5. In use of the device 1 substantially the whole of a body of fluid passed through the vessel 2 may be exposed to a similar substantial level of u.v. irradiation. The device is used in a method of inactivation of micro-organisms and/or lymphocytes in a fluid by irradiating it with u.v. radiation.



The drawing(s) originally filed was (were) informal and the print here reproduced is taken from a later filed formal copy.

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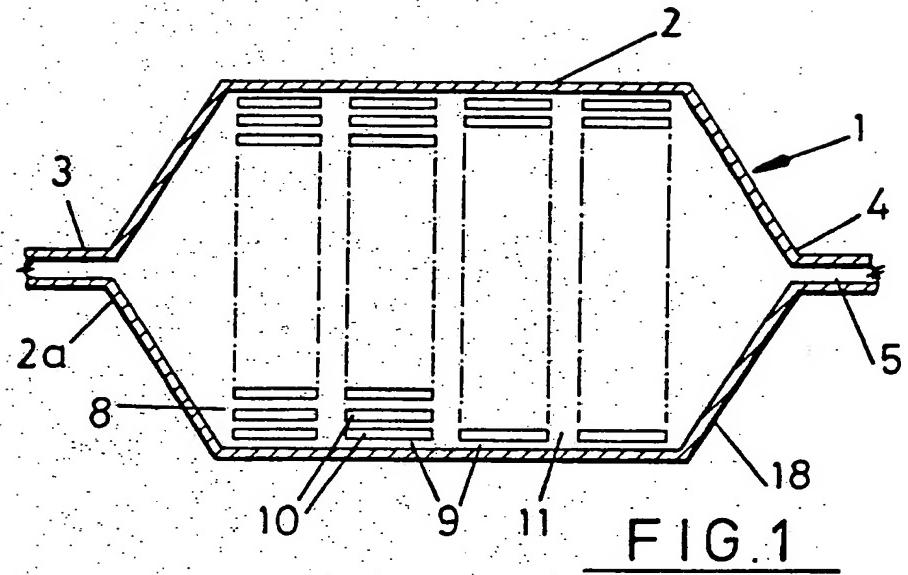


FIG. 1

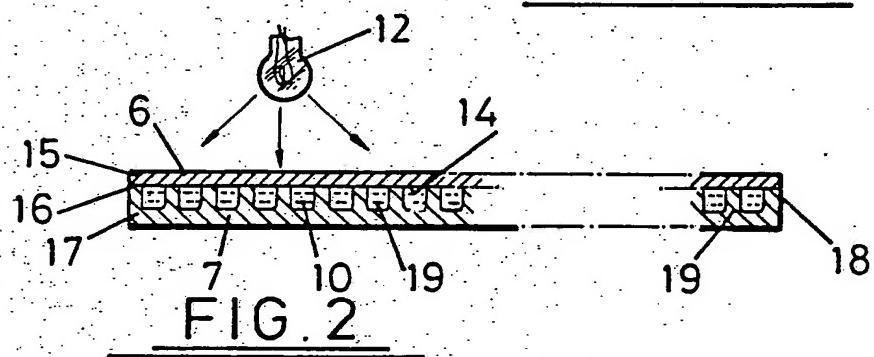


FIG. 2

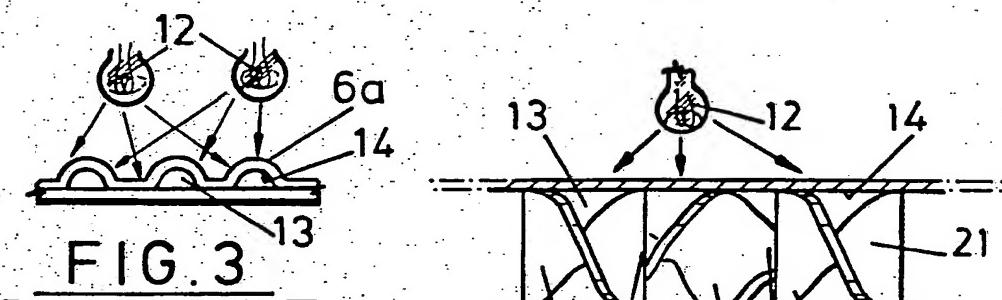


FIG. 3

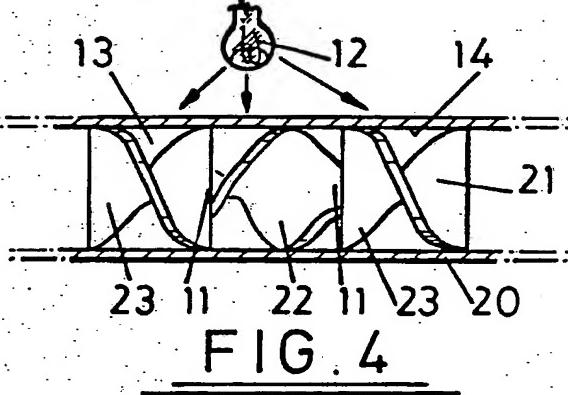


FIG. 4

BODY FLUID PROCESSING DEVICE

The present invention relates to the treatment of body fluids and fractions thereof to inactivate selected components, e.g. lymphocytes and micro-organisms, including viruses and the like in human blood and in particular to a 5 device suitable for use in such a procedure.

Conventionally inactivation of lymphocytes in human blood is generally effected by administration of immuno-suppressive drugs to the patient. This procedure involves however serious risks to the patient due to the 10 various adverse and often severe side effects of such drugs. Whilst various procedures for extracorporeal treatment of blood have been previously proposed these do not produce complete inactivation of the lymphocyte population and/or employ apparatus which is relatively 15 cumbersome, expensive and/or impractical to operate.

In the case of contaminating micro-organisms such as bacteria and viruses, various treatments have been proposed including for example, extended incubation at high temperatures and microwave irradiation. These are slow 20 and/or require relatively expensive apparatus though as well as stringent safety precautions.

It is an object of the present invention to avoid or minimize one or more of the above disadvantages.

The present invention provides a device suitable for

use in the ultra-violet irradiation of a body fluid or a fraction thereof containing lymphocytes and/or micro-organisms which device comprises a vessel having an inlet and an outlet and a passage means extending therebetween, said passage means having wall means substantially transparent to ultra-violet irradiation, said passage means containing at least one irradiation zone extending along and in substantially direct proximity to said wall means, and at least one mixing zone formed and arranged for thoroughly mixing a said fluid passing therethrough so as to bring substantially the whole of the fluid or fraction thereof into a said irradiation zone during passage between said inlet and said outlet, whereby in use of the device substantially the whole of a body of said fluid or fraction thereof passed through said vessel may be exposed to a similar substantial level of irradiation.

In one preferred form of the invention the vessel has between said inlet and outlet, serially and alternately arranged, a plurality of mixing chambers and irradiation zones, each said irradiation zone being constituted by a large plurality of small bore passages extending in generally side-by-side relation between adjoining mixing chambers, said small-bore passages having wall means substantially transparent to ultra-violet irradiation.

In another preferred form of the invention the vessel

has, between said inlet and outlet, radially inwardly of a generally annular radially outer irradiation zone, a static flow mixing means.

Conveniently there is used a static flow mixing means
5 in the form of an elongate screwthreaded member having alternate segments of opposite handed screwthread.

Preferably there is used a static flow mixing means of the interfacial surface generator type whereby the fluid is driven through said generator which divides the inlet
10 fluid stream into a plurality of substreams, then reoriented and recombined the substreams into a main stream, the process being repeated until a desired degree of mixing has been achieved. An improved form of such a mixing means is described in Patent Publication No. 2018609A which document
15 also mentions other publications relating to such mixers.

In a further aspect the present invention provides a method of inactivating lymphocytes and/or micro-organisms in a body fluid or fraction thereof comprising the steps of irradiating the fluid or fraction thereof with ultra-violet
20 radiation whilst passing it through a device of the invention.

Thus by means of the present invention it is possible to process blood or other body fluids so as to inactivate the lymphocytes or micro-organisms contained therein in a
25 simple and economic manner.

- The abovementioned passage wall means of the device at least may be made of various u.v.-transparent materials including for example silica and other u.v.-transparent glasses such as those available under the Trade Names
- 5 Spectrosil and Vitreosil; silicones; cellulose products such as Cellophane (Trade Name); and plastics materials including polyethylene, polyvinylchloride and fluorinated polyalkenes such as polytetrafluoroethylene (PTFE) and fluorinated-ethenepropene (FEP).
- 10 Further preferred features and advantages of the present invention will appear from the following detailed description given by way of example of a preferred embodiment illustrated with reference to the accompanying drawings in which:
- 15 Fig. 1 is a horizontal section through a device of the invention.
- Fig. 2 is a transverse vertical section through the device of Fig. 1 on an enlarged scale;
- 20 Fig. 3 is a corresponding view of a modified embodiment of the same general type as that of Fig. 2; and
- Fig. 4 is a longitudinal section through another embodiment using a static mixer device (not sectioned).